

JUST LIKE LIVING
IN SUNSHINE
ALL WINTER LONG



RADIANT
SUN-LIKE WARMTH
Plus
ALL YEAR ROUND
HOT WATER
FOR KITCHEN, LAUNDRY
AND BATH



Hydro-Flo Radiant Heating

• INDEX •

History of Radiant Panel Heating	Page 2
Theory of Radiant Panel Heating	" 3-4-5
Nature of Radiant Heat Rays	" 3
The Ideal Comfort Condition	" 4
How Radiant Rays are Applied to Heat the House	" 5
Correct Temperatures in Radiant Heated Home	" 5
General Benefits of Radiant Heating	" 6-7
Heat Distribution and Humidity	" 7
Installing and Operating Cost	" 7
Hot Water for Household Use	" 8
Equipment and Operation	" 9-10

BELL & GOSSETT CO.
Morton Grove, Illinois



Hydro-Flo RADIANT PANEL HEATING

Uniform, healthful warmth from a completely concealed Heating System

Just picture your home with *no visible means of heating* in any room! Not a radiator, not a grille to interfere with arrangement of furniture or hamper decorative plans.

Imagine, too, your home bathed all winter long in mellow, sun-like warmth . . . warmth unlike anything you've ever experienced before. No cold spots! No hot spots! No drafts! The floors always warm . . . the air clean, fresh, invigorating . . . and all this with smaller fuel and decorating bills!

These are a few of the benefits of R radiant Panel Heating . . . and the way to have it at its best is with a B & G Hydro-Flo R radiant Panel System! This is a system employing mechanically circulated hot water as the heating medium—proved in both theory and experience to be the most satisfactory method.

Radiant Heating is not new and untried

Radiant heating is actually as old as the universe—the earth itself is warmed by Radiant Heat Rays from the sun. All living things grow and develop under the influence of these stimulating rays.

The discovery of fire enabled man to warm himself *artificially and at any time desired*, for fire (or any heated object) gives off the same kind of radiant heat rays as the sun. From the primitive open fire, we next find the principles of Radiant Heating extensively employed by the early Romans, who heated their public baths and villas with hot gases from charcoal fires passed into flues in the floor and walls. Though crude, this first application of Radiant Heating Panels was effective.

Early in the 20th Century, Radiant Panel Heating reappeared in Europe and in this country, using pipes installed in the floor or ceiling to convey heat to the panels. Since that time, it has gone through a slow, thorough testing process which establishes beyond question the complete superiority of its principles. Radiant Panel Heating, therefore, is not new, except in the application of modern equipment which develops its benefits to the fullest.

In recent years, knowledge of the virtues of Radiant Heating has spread so fast that today it is one of the most discussed features of building construction.



The sun's Radiant Rays are keeping these bathers perfectly comfortable, though the air temperature is below freezing.

THE THEORY OF RADIANT PANEL HEATING

Thousands of people are already enjoying the multiple benefits of Radiant Heating. To those who are now planning new homes, therefore, the theory of Radiant Panel Heating should be of compelling interest, for this modern heating method introduces new comfort, economy, and esthetic values far beyond any of today's standards.

First of all, what are Radiant Heat Rays

To understand fully the relation of Radiant Heat Rays to human comfort, their characteristics must be examined.

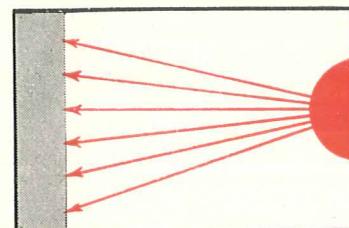
Any heated object gives off Radiant Heat Rays; the sun, for instance, warms the earth with its emission of these rays. Radiant Rays behave very much like light rays, because they travel in straight lines and are absorbed and reflected to a degree depending upon the nature of the surface they strike against.

Radiant Rays pass through the air without appreciably raising its temperature—the outer spaces, for example, through which the sun's rays travel before they reach the earth, are intensely cold. These rays, however, warm every solid object they meet.

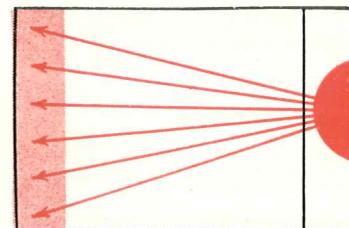
Radiant Rays always move from warm to cooler objects. When they strike a cooler surface, a portion of them is absorbed and the balance reflected. The absorbed rays warm the surface, which then becomes a radiant surface itself and *re-radiates* its own rays.

The effect of Radiant Rays is clearly demonstrated on days when the sun is bright but the air cool. When standing in the sunshine you are comfortably warm—moving into the shade causes a sensation of chilliness. You have been cut off from the sun's Radiant Rays and immediately notice a change in your comfort status.

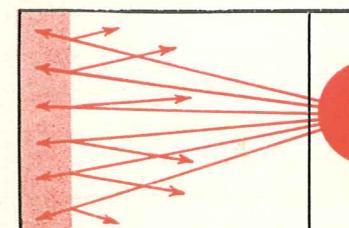
These characteristics of movement, absorption and reflection are the qualities upon which Radiant Panel Heating is based.



Radiant Rays move from warm to cooler surfaces



A portion of the Radiant Rays are absorbed by the cooler surface, thereby warming it



The balance of the Rays are reflected to other surrounding cooler surfaces

Radiant Panel Heating calls for a new conception of how comfort is attained

To understand Radiant Panel Heating it is necessary for most of us to arrive at an entirely new concept of what keeps the human body from feeling cold. It must be understood that *comfort is not a matter of supplying heat to the body but instead, one of controlling the rate and manner in which heat is lost from the body!*

In utilizing the food we eat and the air we breathe, the body develops a considerable amount of excess heat. To maintain comfort and health, the body must continuously dissipate this excess. If surrounding conditions are such that we dispel it too fast, we feel cold; if too slowly, we feel hot.

The body loses heat in three principal ways

Excess body heat is dissipated in three principal ways . . . by Radiation, Convection and Evaporation. The *Radiation* loss is the amount of heat given off by the warm body to surrounding cooler objects. The *Convection* loss is the heat carried away by the passage of air over the skin and clothing and the *Evaporation* loss is the heat used up in converting moisture on the surface of the body into vapor. There has been much scientific investigation to determine the conditions which provide greatest bodily comfort. In these experiments, body heat loss is measured in BTU, a standard measure of heat. The average person in normal activity should emit about 400 BTU per hour, and of this total, Radiation and Convection account for 300 to 320 BTU. Since this is obviously the major portion, the problem of providing comfort is principally concerned with establishing the proper balance between Radiation and Convection heat loss.

The Comfort Balance

The human body has remarkable ability to adjust

itself to varying temperature conditions. If, for example, the air becomes cooler and accordingly the amount of heat given off to the air *increased* (by Convection), the body can still adjust itself to a sense of comfort if the heat given off by Radiation is *decreased*. The amount given off by Radiation can be decreased by *raising the temperature of the surrounding surfaces*, such as the walls, floor and ceiling.

In other words, within quite a range of temperature, the body doesn't care if its excess heat is given off by Convection to the air, or by Radiation to the surfaces surrounding it, provided that the proper balance is achieved between the two kinds of heat loss. For comfort, the body does demand that if the amount of heat given off by Convection *increases*, the heat given off by Radiation must *decrease* and vice-versa.

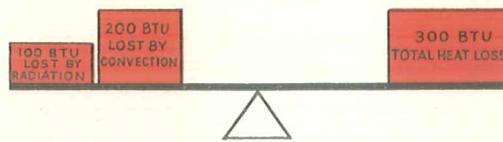
An excellent demonstration of this fact is shown in the photograph on page 3. Here, at Sun Valley, bathers are perfectly comfortable in air temperatures which frequently go below zero. The

cold air increases the Convection heat loss from the body, but at the same time, Radiant Heat Rays from the sun, striking on the bathers directly and by reflection from the snow, cause such a *decrease in the amount of body heat escaping by Radiation* that perfect comfort results.

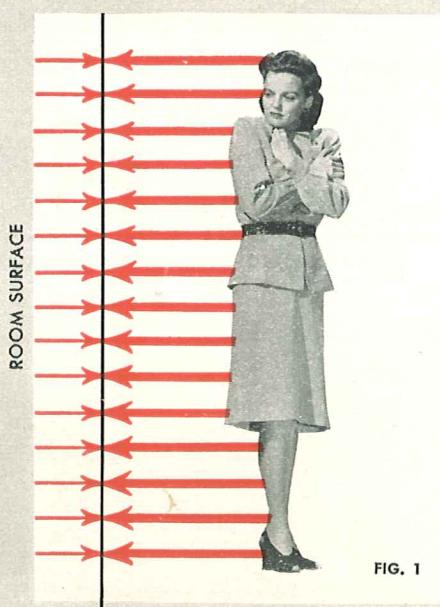
For easy visualization of the above statement, think of Radiant Heat as being *radiant pressure*. Then think of the body as having too much *radiant pressure*, needing to release some, but not all, if it is to be comfortable. To control the amount of radiant pressure released, we can surround the body with an *opposing* radiant pressure from surrounding surfaces, such as the walls, floor and ceiling. Figures 1, 2 and 3 below show the idea diagrammatically.



For comfort, the amounts of body heat given off by Convection and Radiation can be in any ratio, provided that their sum equals the total of about 300 BTU per hour.



Considering the radiant heat in the body as Radiant Pressure, a controlled rate of release is required for comfort. By opposing it with Radiant Pressure from the room surfaces, the proper rate of emission can be established.



RADIANT PRESSURE
TOO LITTLE

FIG. 1



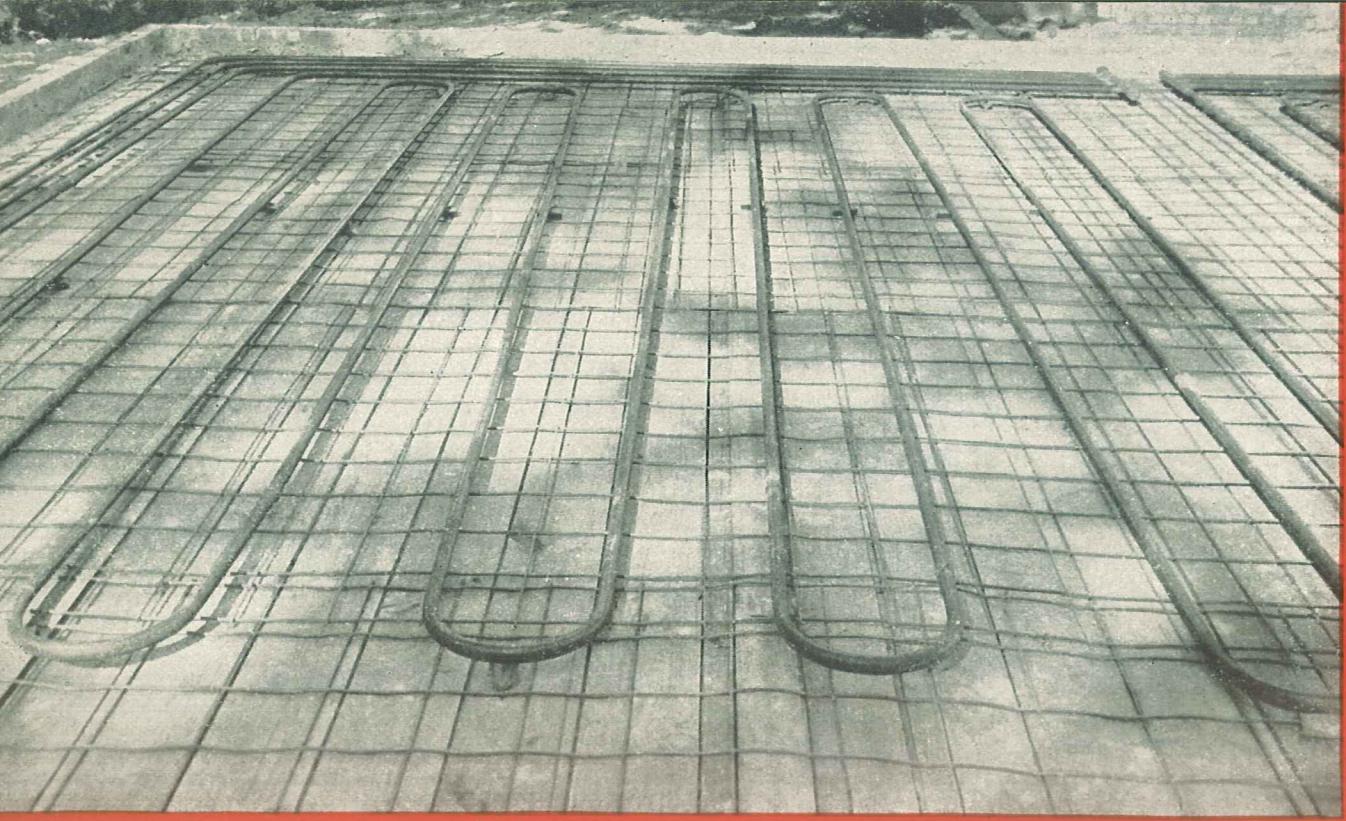
RADIANT PRESSURE
RELEASE TOO SMALL

FIG. 2



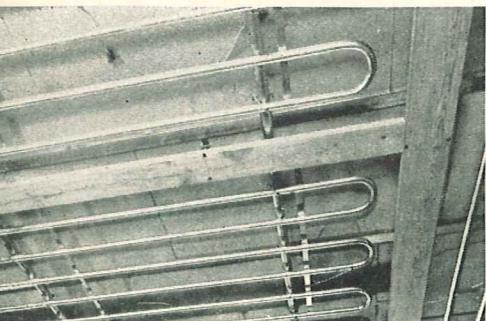
RADIANT PRESSURE
RELEASE JUST RIGHT
FOR COMFORT

FIG. 3

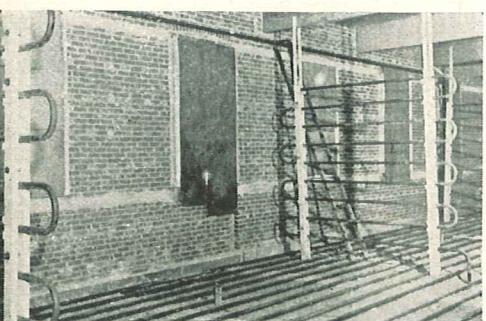


This photo shows pipe coils installed just prior to pouring the concrete floor

THE THEORY OF RADIANT PANEL HEATING (Cont'd)



Placing the pipe coils in the ceiling is another way in which Radiant Panels can be installed.



Pipe coils in the walls—generally used as an auxiliary source of Radiant Heat when floor or ceiling areas are not large enough to accommodate properly sized Panels.

How Radiant Rays are used to heat the home

Even with the kind of heating you have known in the past, radiant heat has been a factor. The walls, floor and ceiling must be warmed before comfort can be achieved—*warm air alone is not sufficient!*

In the conventional heating system, the attempt to warm the structure is made either by Convection heating alone or by a combination of Convection and Radiation heating. For example, with a warm air heating system, the heated air alone in the room is expected to warm the walls, floor and ceiling.

This approach to correct heating has the disadvantage of requiring that room air be maintained at a temperature frequently so high that the comfort balance is disturbed.

In Radiant Panel Heating the process is reversed. Instead of overheating the room air to heat the structure, the room surfaces are warmed from behind and the air becomes warmed by contact with them. Instead of *concentrated areas* of high temperature heat emission, such as registers and radiators, *large areas* of mildly heated floor, ceiling and walls supply over-all mellow warmth with lower, more refreshing room air temperature.

By accurately controlling the temperature of the room surfaces, *as it is done in Radiant Panel Heating*, the amount of body heat given off by Radiation can likewise be controlled to establish ideal comfort conditions.

The method most used to obtain these large heating areas is to install pipe coils in the floor or ceiling and sometimes in the walls. In any case the heating effect is the same, as Radiant Rays, like light rays, travel and are reflected in all directions, without being affected by air currents. The pipe coils can be installed in any of the constructions normally used in building. Some examples are shown on this page.

At what temperature should the Radiant Panel Heated home be kept

We have pointed out in the foregoing that comfort conditions can be established through a wide range of air temperatures, providing that the Radiant heat loss of the body is properly controlled. Generally speaking, the practice is to design the modern Radiant Panel Heating System so that the air temperature is somewhat lower than that maintained in the conventionally heated home. To compensate for the increased loss of body heat by Convection, the temperature of the room surfaces is raised to decrease the heat loss by Radiation.

Lower air temperatures have distinct advantages in that the air feels fresher, invigorating and humidity conditions are greatly improved.



In this gracious modern room there are neither radiators nor grilles to disturb its decorative harmony.

COMFORT, CONVENIENCE AND ECONOMY YOU'VE NEVER KNOWN BEFORE

B & G Hydro-Flo Radiant Panel Heating is completely concealed

What woman would not rejoice at the thought of a home in which all evidence of the heating system was absent! Not a radiator—not a grille—not a pipe to collect dirt and interfere with tasteful room decoration and arrangement. The spaces under the windows and along the walls are completely unobstructed and can be used in any manner desired.

Build any kind of home you like . . . modern or traditional . . . with or without basement . . . and B & G *Hydro-Flo* Radiant Panel Heating will assure decorative freedom and cleanliness you've never before experienced.

Warm, draftless floors—healthier living conditions

Perhaps nothing causes more discomfort than cold floors—if your feet and legs are cold, you are cold all over. This common fault of ordinary heating systems is ended by B & G *Hydro-Flo* Radiant Panel Heating. Regardless of whether the coils are in the floor or ceiling, all surfaces are warmed by the absorption of Radiant Heat Rays from the main radiating panel and by reflection and re-radiation from one surface to another.

The warm floors and draftless conditions in the radiant heated home contribute materially to more healthful living. To families with babies or children at the crawling age, this feature is particularly valuable as a safeguard against colds due to drafts and uneven temperatures.

Floor coverings do not disturb the operation of a Radiant Panel system, because whatever insulating effect they may have is so slight that it can be ignored.



Warm floors—more uniform temperature all through the house



Walls and draperies stay bright and clean much longer

Better humidity—clean, refreshing air

It has been pointed out that ordinary heating systems depend upon heat sources small in area and maintained at high temperatures. The result is higher air temperatures, lower humidity, less convected and more radiated body heat loss, all of which induce less comfortable conditions.

With a B & G *Hydro-Flo* Radiant Panel System, perfect comfort can be maintained at lower air temperature because the radiant heat loss from the body is restricted by the warm surrounding surfaces. Lower air temperature means that the need for additional humidity is lessened and the air feels fresher and more invigorating.

Clean walls and ceilings

In the home heated with a conventional heating system, air movement in the rooms is often quite pronounced, due either to thermal circulation above heated radiators or to blower-circulated air entering the room through grilles.

These air currents pick up dust and dirt from the floor and deposit them on walls, ceilings and draperies. Experiments show that dirt has a tendency to settle on cold surfaces—hence the comparatively cold walls of the home with an ordinary heating system are natural dirt collecting areas.

What a contrast exists in the home heated with Radiant Panels! Here the large area, low temperature heating surfaces induce very little air movement. In addition, all room surfaces are comparatively warm and thus offer little attraction for the deposit of dirt. This keeps cleaning and decorating bills at a minimum.

Heat distribution is amazingly uniform

The diagrams below illustrate the superior heat distribution of B & G *Hydro-Flo* Radiant Panel Heating. Where heat is supplied by an ordinary heating system (Fig. 4), there is a wide variation in temperature between floor and ceiling, with the cooler air at the floor where it is least desirable.

Radiant heated rooms, however, have a very small differential in temperature between floor and ceiling. Figure 5 shows a floor installation of radiant pipe coils which illustrates both the uniformity of temperature throughout the room and also the manner in which Radiant Rays are reflected or re-radiated to all surfaces.



Heating costs are amazingly low

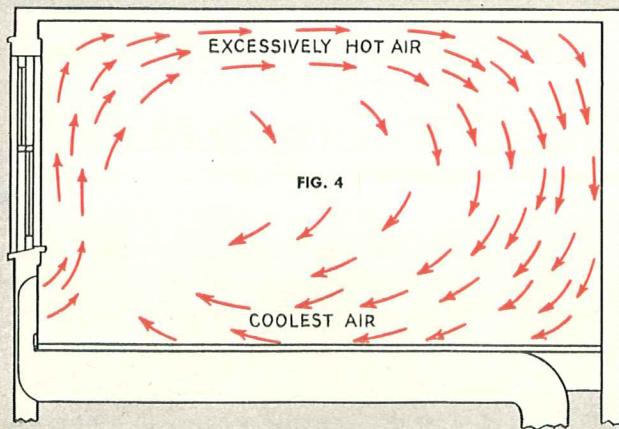
What about installing and operating cost?

You might be expected to think that such an outstanding improvement in your living comfort would command a premium price. Home planners will therefore be surprised and delighted to learn that B & G *Hydro-Flo* Radiant Panel Heating comes within the usual percentage of cost allotted to the heating plant. In many actual installations the cost has proved to be about the same as for an ordinary heating system.

Better still, the operating cost has been shown to be as much as 25% less.

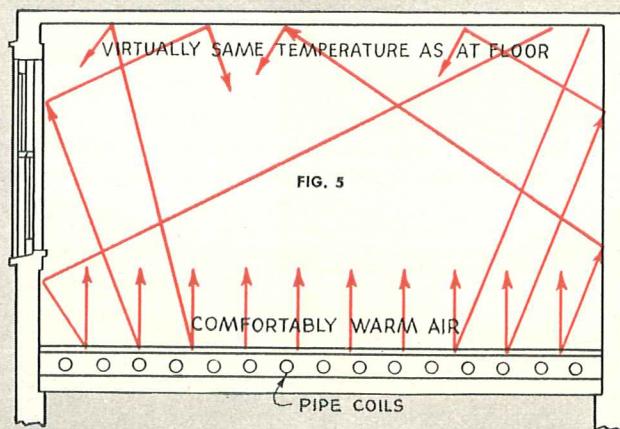
Do you wonder that Radiant Panel Heating has so strongly gripped the interest of today's home builders?

A Radiant Heating System distributes heat more uniformly in every room



ORDINARY HEATING SYSTEM

In this type of system, air is delivered at high temperature to heat the room. Since heated air rises, the temperature at the ceiling is much higher than at the floor, which may be uncomfortably cool.

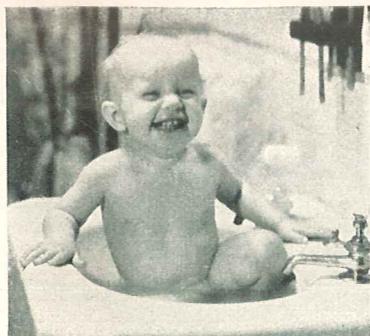


RADIANT HEATING SYSTEM

Radiant Rays from the pipe coils in the floor directly strike or are reflected like light rays to all room surfaces, warming them to the proper degree. Note that air temperature varies but little from floor to ceiling, with warmest air at the floor, where it should be for maximum comfort.



What greater luxury than abundant hot water at any hour of the day or night.



YEAR 'ROUND HOT WATER ... A PLUS VALUE

Certainly you can *get along* without the convenience of ample hot water. But who, in this day of modern comforts, can be content with anything less than an abundant supply of it—24 hours a day—all year 'round.

Every household task, from dishwashing to house cleaning is shortened, made easier when piping hot water is at your command. Every gratifying little luxury of personal care and cleanliness can be enjoyed to the utmost. And remember that modern dish and clothes washers can't be operated on a mere trickle of hot water!

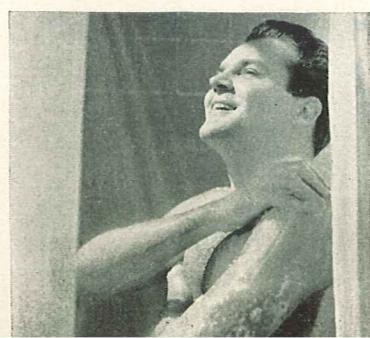
So here is the plus value of B & G *Hydro-Flo* Radiant Panel Heating—*all the hot water you can use for kitchen, laundry and bath!* With this system in your home your hot water is furnished in virtually limitless quantities, all around the clock and calendar.



When considering fuel cost, remember that heating your domestic water is definitely a part of it

Not only does a B & G *Hydro-Flo* Radiant Panel System supply ample quantities of hot water but it does so at exceedingly low cost. In the first place, the same boiler that supplies heat to the Radiant Panels is also used to heat your domestic water—Winter, Summer, Fall and Spring. No separately fired heater is required.

It hardly seems possible, in comparing the size of your heating boiler with that of a separate heater, that it could be fired in summer to heat the household water economically. Yet this is definitely so, as proved in thousands of installations now in operation. The exact method of operation is explained in detail on page 10.



THE OPERATING EQUIPMENT OF A **B & G Hydro-Flo RADIANT PANEL HEATING SYSTEM**

Engineering authorities agree that mechanically circulated (forced) hot water is the most satisfactory way to supply heat to Radiant Panels. The ease with which water can be heated, circulated and controlled with the simplest kind of equipment is the reason for this preference. The comparatively low temperatures required in the pipe coil panels of a Radiant Heating System can be accurately maintained when forced hot water is used as the heating medium.

B & G Forced Hot Water Equipment for heating systems employing radiators or convectors has made an enviable reputation all over the world. Today you will find B & G Systems installed in several hundred thousand homes, apartments, commercial and industrial buildings—heating with dependability and economy. Since the problem of supplying heated water to Radiant Panels is no different from that of supplying it to radiators, the use of B & G equipment to circulate and control the flow of water is a logical and sound selection. It is merely applying equipment of proved merit to arrive at an improved method of heat distribution and control.

Simple, dependable equipment

The operating equipment of a B & G *Hydro-Flo* Radiant Panel Heating System is extremely simple and can be installed on any hot water heating boiler. It consists of an electrically operated B & G Booster Pump for circulating warm water from the boiler to the Radiant Panels . . . a B & G Flo-Control Valve or By-Pass Valve (depending on the type of controls selected) to

shut off circulation when the heat requirement is satisfied . . . and a Water Heater which provides year 'round hot water for all household uses. Auxiliary equipment consists of a B & G Relief Valve and B & G Compression Tank.

Two methods of control

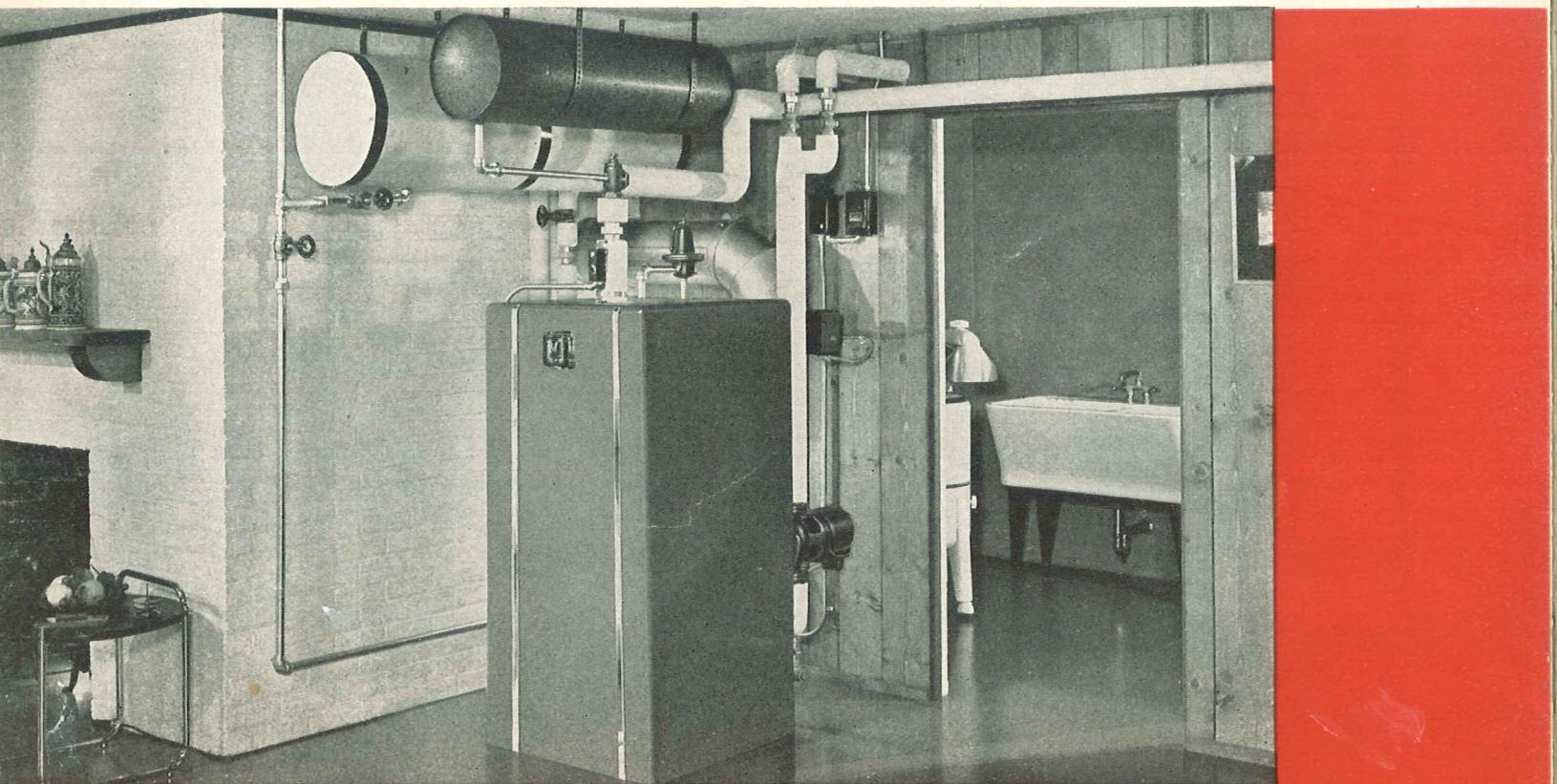
There are two basic methods of controlling the operation of a B & G *Hydro-Flo* Radiant Heating System. The simplest way is with an ordinary room thermostat, a method which is producing very satisfactory results. With this type of control it is necessary to use a storage tank in conjunction with the B & G Water Heater.

The second method calls for an "Outdoor-Indoor" control, with water continuously circulated through the Radiant Panels. This type assures a close control of temperature and permits use of an "instantaneous" Water Heater, which does not require a storage tank.

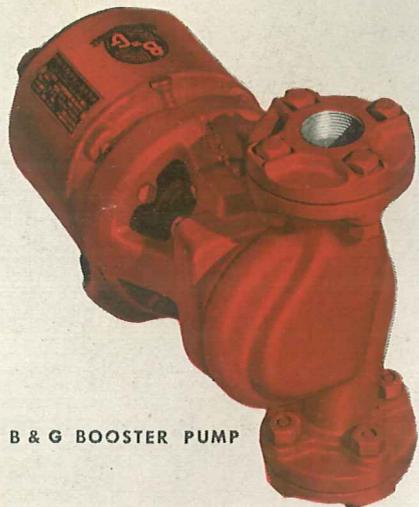
Operation with Room Thermostat Control

In this type of system, an ordinary room thermostat is used to control operation. When the thermostat calls for heat, the Booster Pump starts and rapidly circulates heated water through the Radiant Panels until the heat requirement is satisfied. The Pump is then shut off by the thermostat.

As long as the Pump is running, the Flo-Control Valve is forced open by the flow of water through the pipes, permitting free circulation of heated water through the system. The moment the Booster stops, the Flo-



Typical installation of
B & G Hydro-Flo Heating System.



B & G BOOSTER PUMP



B & G
FLO-CONTROL
VALVE



B & G
WATER
HEATER

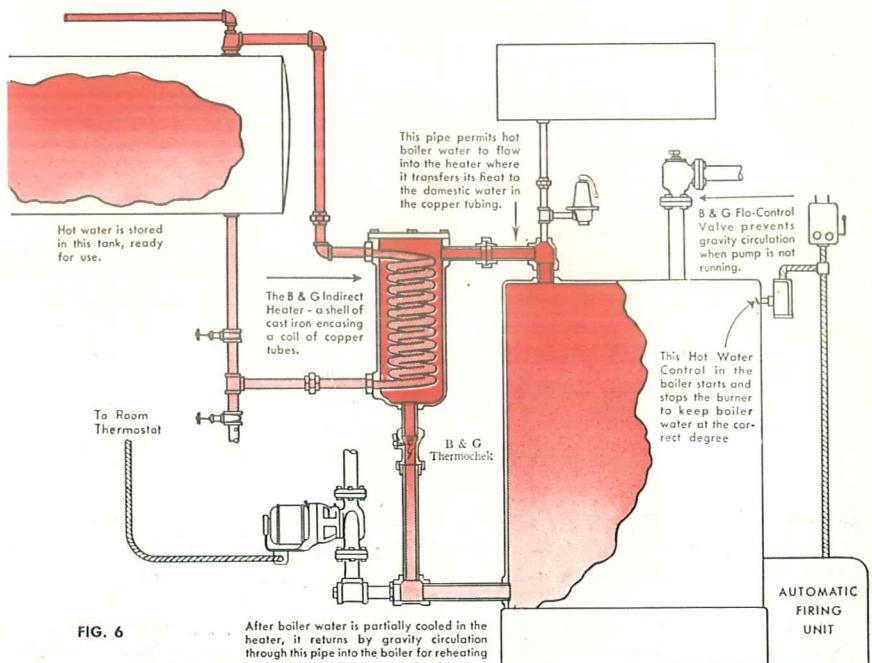
Control Valve closes, preventing circulation by gravity, which might cause overheating.

Operation with Outdoor-Indoor Control

This type of system differs from the installation controlled by a room thermostat in that water is *continuously circulated* through the Radiant Panels. Hot water from the boiler is admitted to the system in modulated quantities when the temperature of the circulating water drops below the heat requirement of the Panels.

This modulated "bleeding" of boiler water into the Panel piping is accomplished through a By-Pass Valve. When no additional heat is required the Valve is closed. When more heat is required, the Valve is gradually opened by the coordinated action of an outdoor temperature bulb and a temperature bulb installed in the supply main.

By this method of control, the temperature of the water in the Panels is automatically varied to meet outdoor temperature conditions, being always just warm enough to maintain *constant indoor comfort*. The Booster Pump is automatically shut off when outdoor temperature rises above 65°.



How the house heating boiler also heats water for kitchen, laundry and bath

Figure 6 above shows you why a separately fired water heater is not required when you have a B & G *Hydro-Flo* Radiant Panel Heating System.

The B & G Water Heater consists of a coil of copper tubing encased within a cast iron shell. It is connected to the boiler with pipes which permit hot boiler water to flow through the shell and around the copper tubes.

Domestic water flows from the storage tank through the tubes in the Heater, where it is heated by the surrounding hot boiler water. It then circulates back to the storage tank where it is stored ready for use. Note that domestic water never mixes with the boiler water, as it is confined within the copper tubes of the heater.

During the winter, the heating boiler is, of course, in constant use, but only a small part of the heat generated is used in heating the domestic water. This means that hot water is produced at very little cost. In summer a similar economy is achieved. The boiler water can be maintained at the proper temperature for heating the domestic water by only a few short daily operations of the burner. The Radiant Panels will not heat up during summer operation of the boiler. Since there is no call for heat, the Booster does not run. Consequently, the Flo-Control Valve or the By-Pass Valve remains tightly closed and no heated water can pass into the Panels.

CONTROLS

Whether you elect to use Room Thermostat or Outdoor-Indoor control, you have a choice of excellent equipment made by several different manufacturers. Your architect, builder or heating contractor will help you make the selection best suited to your needs.



BELL & GOSSETT CO.

MORTON GROVE, ILLINOIS

**Makers of Forced Hot Water Heating Systems
... Residential and Industrial Water Heaters ...
Pumps ... Heat Exchangers.**